GR 98 P 8075

Description

Method for controlling data transmission in a wireless V.24 data transmission system operating between a data terminal and a data transmission device for data telecommunication

Data telecommunication (Datel) is the reciprocal transmission and reception of data or data signals (packet data) between a data terminal - e.g. a personal computer, data terminals, data-processing systems, etc. - and a remote data terminal - e.g. a personal computer, data terminals, data-processing systems, etc. - via a telecommunications network, for example a public telecommunications network (Stw.: ISDN, PSTN, etc.). So that the data or data signals transmitted by the data terminal can be transmitted via the telecommunications network, a technical network apparatus, referred to as the data transmission device, is provided between the data terminal and the telecommunications network. The most commonly used data transmission device, along with the PC card (formerly known as the PCMCIA card), is the modem (artificial word made up from modulator/demodulator) [cf., inter alia, utility model DE 297 14 588 U1].

The modem is an electrical data transmission device operating on the basis of the carrier method for use on limited-bandwidth analog transmission paths - e.g. telecommunications lines (e.g. a/b line pair, ISDN-S_0 bus, etc.) of the telecommunications network, which converts digital data signals into analog data signals and vice versa, and transmits said signals. A multiplicity of V-series methods standardized by the International Telecommunication Union - Telecommunication Standards (ITU-T) are implemented in modems.

FIGURE 1 shows a data telecommunication scenario on the basis of a V.24 data transmission system. A V.24

data transmission system is connected via a public - e.g. a PSTN (**P**ublic **S**witched **T**elecommunication **N**etwork) having an a/b line pair or an ISDN (**I**ntegrated **S**ervices **D**igital **N**etwork) having an ISDN-S_0 bus - telecommunications network to the remote V.24 data transmission system. The V.24 data transmission system has a data terminal DEE, e.g. designed as a personal computer, and a data transmission device DÜE designed as a modem, which are interconnected via a V.24 cable (V.24 interface) $K_{V.24}$.

Analogously, the remote V.24 data transmission system has a remote data terminal DEE_f, e.g. designed as a personal computer, and a remote data transmission device $DÜE_f$, e.g. designed as a modem, which are likewise interconnected via a V.24 cable (V.24 interface) $K_{V.24}$.

The data terminal DEE, DEE_f contains a system controller SST with a user interface BOF, application software ASW and a driver TR as an adapter between the software (application software) and the hardware (data transmission device or modem).

The driver TR is modem-vendor-specific and is preferably designed as a CAPI driver (**C**ommon ISDN **A**pplication **P**rogrammable **I**nterface; standardized communications interface with the application software for fault-tolerant ISDN telecommunication with the personal computer) or as a TAPI driver (**T**elephone **A**pplication **P**rogrammable **I**nterface).

A multiplicity of data transmission apparatus DÜE which are available on the market, e.g. analog modems and PC-external ISDN terminal adapters, are controlled via a HAYES command set (HAYES standard). The HAYES standard was originally an American industry standard for modem communication, in particular for modem control by the data

terminal DEE. It is also referred to as the AT standard, since virtually all commands from the HAYES command set begin with the prefix "AT" (**AT**tention) with the ASCII characters A and T. The standard, which has since been introduced worldwide, is the subject of an ITU recommendation (International Telecommunication Union) with the title "ITU-T V.25ter". The prefix "at", the prefix "A/" or the prefix "a/" can also be used instead of the prefix "AT".

According to ITU-T specification V.24, March 1993, pages 1 to 19, the V.24 cable or V.24 interface $K_{V.24}$ supports modem operation on a personal computer through different lines (status lines). These are:

1. A transmit data line TxD for data transmission,
2. a receive data line RxD for data transmission,
3. an RTS line (**R**eady **T**o **S**end) RTS for the "hardware-handshake" transmission type for transmission of the "**R**EADY **T**O **S**END" state ("RTS" state),
4. a CTS line (**C**lear **T**o **S**end") CTS for the "hardware-handshake" transmission type for transmission of the "**C**LEAR **T**O **S**END" state ("CTS" state),
5. an RI line (**R**ing **I**ndication) RI for ring detection, on the modem,
6. a DSR line (**D**ATA **S**ET **R**EADY) DSR, on which the modem signals to the personal computer that it is activated,
7. a DTR line (**D**ATA **T**ERMINAL **R**EADY) DTR, on which the personal computer signals to the modem that it is activated and ready to accept connections,
8. a DCD line (**D**ATA **C**HANNEL **D**ETECTION) DCD, on which the modem signals to the personal computer that it has accepted or set up the connection to a remote modem,
9. A ground line (**G**rou**ND**) GND.

If the V.24 cable or V.24 interface $K_{V.24}$ does not have the nine lines listed above, but has less than nine, e.g. seven, this 7-pin cable can nevertheless support modem operation on the personal computer.

This is done by effecting a "software handshake" instead of the "hardware handshake" on the RTS/CTS line in order to transmit the "RTS", "CTS" states - e.g. by means of an XON/XOFF protocol - on the transmit/receive data lines TxD, RxD. With the "software handshake", the data stream transmitted between the data terminal DEE and the data transmission device DÜE is analyzed, all "software handshake characters" are interpreted and appropriate measures are instigated in the data terminal DEE and the data transmission device DÜE.

The line-connected V.24 data transmission system shown in FIGURE 1 presents the disadvantage, in the case of an application scenario in which the data terminal DEE and the data transmission device DÜE are physically separated from one another, e.g. over several meters, that, firstly, for data telecommunication, a correspondingly long V.24 cable $K_{V.24}$ is required in relation to the physical arrangement of the data terminal DEE and the data transmission device DÜE and that, secondly, significantly high system installation costs are incurred due to the cable laying required for cables of this length.

By analogy with wireless telephony, it is therefore desirable and also conceivable for the line-connected V.24 data transmission system according to FIGURE 1 to be replaced with a wireless V.24 data transmission system.

On the basis of FIGURE 1, FIGURE 2 shows a wireless V.24 data transmission system of this type for data telecommunication. The remote V.24 data transmission system, which is not fully shown in FIGURE 2, may either be line-connected according to FIGURE 1 or wireless in the same way as the wireless V.24 data transmission system in FIGURE 2.

In the wireless V.24 data transmission system, in contrast to the line-connected V.24 data transmission system in FIGURE 1, the V.24 cable and V.24 interface $K_{V.24}$ are

disconnected between the data terminal DEE and the data transmission device DÜE and a data transmission apparatus is in each case connected to the two ends of the cable created by the disconnection.

The two data transmission apparatus, a first data transmission apparatus DÜG1 which is connected to the data terminal DEE via the V.24 cable or V.24 interface $K_{V.24}$ and a second data transmission apparatus DÜG2 which is connected to the data transmission device DÜE via the V.24 cable or V.24 interface $K_{V.24}$ are interconnected via an air interface LSS for wireless telecommunication.

Air interfaces are wireless telecommunication interfaces in which messages are transmitted by wireless means via a remote transmission path between a message source (e.g. first data transmission apparatus DÜG1) and a message sink (e.g. second data transmission apparatus DÜG2) on the basis of diverse communications methods FDMA (**F**requency **D**ivision **M**ultiple **A**ccess), TDMA (**T**ime **D**ivision **M**ultiple **A**ccess) and/or CDMA (**C**ode **D**ivision **M**ultiple **A**ccess) - e.g. according to radio standards such as DECT [**D**igital **E**nhanced (formerly: **E**uropean) **C**ordless **T**elecommunication; cf. *Nachrichtentechnik Elektronik 42 (1992) Jan./Feb. Issue 1, Berlin, DE; U. Pilger "Struktur des DECT Standards" ["Structure of the DECT Standard"], pages 23 to 29* **in conjunction with** ETSI Publication *ETS 300175-1...9, October 1992,* and the DECT publication of the *DECT Forum, February 1997, pages 1 to 16]*, GSM [**G**roupe **S**pécial **M**obile or **G**lobal **S**ystem for **M**obile Communication; cf. *Informatik Spektrum 14 (1991), June, Issue 3, Berlin, DE; A. Mann: "Der GSM Standard - Grundlage für digitale europäische Mobilfunknetze" ["The GSM Standard - Foundation for Digital European Mobile Networks"], pages 137 to 152* **in conjunction with** the

publication *telekom praxis 4/1993, P. Smolka "GSM Funkschnittstelle - Elemente und Funktionen" ["GSM Radio Interface - Elements and Functions"], pages 17 to 24]*, UMTS [cf. *Funkschau 6/98: R. Sietmann "Ringen um die UMTS Schnittstelle" ["The Fight for the UMTS Interface"], pages 76 to 81]*, WACS or PACS, IS-54, IS-95, PHS, PDC, etc. [cf. IEEE Communications Magazine, January 1995, pages 50 to 57; D.D. Falconer

et al: "Time Division Multiple Access Methods for Wireless Personal Communications"].

In FIGURE 2, the DECT air interface is preferably provided as the air interface LSS. According to the publication *"Vortrag von A. Elberse, M. Barry, G. Fleming zum Thema [Presentation by A. Elberse, M. Barry, G. Fleming on the subject of]: "DECT Data services - DECT in Fixed and Mobile Networks", June 17/18, 1996, Hotel Sofitel, Paris; pages 1 to 12 and abstract"* - on the basis of the document *Nachrichtentechnik Elektronik 42 (1992) Jan./Feb. Issue 1, Berlin, DE; U. Pilger "Struktur des DECT Standards" ["Structure of the DECT Standard"], pages 23 to 29* **in conjunction with** ETSI Publication *ETS 300175-1…9, October 1992* and the documents *Components 31 (1993), Issue 6, pages 215 to 218; S. Althammer, D. Brückmann: "Hochoptimierte IC's für DECT Schnürlostelefone" ["Highly Optimized ICs for DECT wireless telephones"]* and WO 96/38991 (cf. Figures 5 and 6 with the relevant associated description) - the essential usability of DECT technology (Digital Enhanced Cordless Telecommunication], DECT technology is suitable for wireless mobile remote transmission of voice and/or packet data, in which the user, by means of DECT network access technology relating to the remote transmission of user data, can not only become his own network operator but also has the facility to access a higher-order telecommunications network.

In a wireless V.24 data transmission system operating between a data terminal and a data transmission device for data telecommunication, the object on which the invention is based entails the control of the transmission of the states "RTS", "CTS" in such a way that reliable reciprocal notification of the state is effected in the wireless V.24 data transmission

system in a simple manner for different state transmission types (hardware handshake or software handshake).

This object is achieved by the features of claim 1.

The idea on which the object is based consists in that, in a wireless V.24 data transmission system operating between a data terminal (e.g. a personal computer) and a data transmission device (e.g. a modem) for data telecommunication, a first data transmission apparatus connected to the data terminal via a V.24 cable and a second data transmission apparatus connected to the data transmission device via a V.24 cable, which in turn can be connected by means of wireless telecommunication via an air interface,

a) in "hardware handshake mode" for transmission of the "RTS", "CTS" states in which status lines RTS, CTS are used, in each case switch to a local processing mode in which the respective V.24 data transmission apparatus locally processes the "RTS", "CTS" states transmitted on these lines in relation to the RTS/CTS status lines,

b) in "software handshake mode" for transmission of the "RTS", "CTS" states in which a data stream transmitted on data lines is used, in each case switch to a local processing mode in which the respective V.24 data transmission apparatus locally processes the "RTS", "CTS" states transmitted in this data stream in relation to this data stream.

This enables the respective V.24 data transmission apparatus, if the input buffer in the relevant V.24 data transmission apparatus overflows with data arriving in the device, to signal this state to the distant end connected via the V.24 cable, thereby temporarily interrupting the further inflow of data. This would not be possible if the RTS/CTS status lines were "looped through" via the air interface or if the software handshake characters were transferred via the air interface.

Advantageous embodiments of the invention are indicated in the subclaims.

One embodiment of the invention is explained with reference to FIGURE 3.

FIGURE 3 shows the wireless V.24 data transmission system according to FIGURE 2, in which the data transmission is controlled as follows:

When the wireless V.24 data transmission system is commissioned or the data terminal DEE, the data transmission device DÜE and the V.24 data transmission apparatus DÜG1, DÜG2 are activated, the V.24 data transmission apparatus DÜG1, DÜG2, the data terminal DEE and the data transmission device DÜE are operated in a command data transmission mode, in which command data KD are transmitted between the data terminal DEE and the data transmission device DÜE via the V.24 cable $K_{V.24}$ and the air interface LSS.

The command data KD transmitted in the command data transmission mode may contain, for example, first command data KD1, indicating that a "software handshake" is to be performed between the data terminal DEE and the data transmission device DÜE for transmission of the "RTS", "CTS" states - e.g. by means of the XON/XOFF protocol - in a data stream on the data lines TxD, RxD, or may contain, for example, second command data indicating that a "hardware handshake" is to be performed between the data terminal DEE and the data transmission device DÜE for transmission of the "RTS", "CTS" states on the status lines RTS, CTS.

As an alternative to the procedure in which the "hardware handshake" or "software handshake" transmission type which is to be set is notified by means of command data KD1, KD2, it is also possible for the "software handshake" or "hardware handshake" to be preconfigured, preferably manually.

In the event that the transmission type is preconfigured and therefore the first command data KD1 or the second command data KD2 are transmitted between the data terminal DEE and the data transmission device DÜE, preferably the first V.24 data transmission apparatus DÜG1 detects the transmission type to be set and transfers this to the second V.24 data transmission apparatus DÜG2.

Alternatively, it also possible for

1. the second V.24 data transmission apparatus DÜG2 to detect the transmission type to be set and to transfer this to the first V.24 data transmission apparatus DÜG1, or

2. the first V.24 data transmission apparatus DÜG1 and the second V.24 data transmission apparatus DÜG2 to detect the transmission type to be set.

In the last-mentioned case, the transmission type is not transferred between the V.24 data transmission apparatus DÜG1, DÜG2.

If it detects or has received the second command data KD2, the first V.24 data transmission apparatus DÜG1 switches to a first special mode SM1 assigned to the "hardware handshake", in which the first V.24 data transmission apparatus DÜG1, in relation to the status lines RTS, CTS, locally handles the "RTS", "CTS" states transmitted on these lines between the data terminal DEE and the first V.24 data transmission apparatus DÜG1. The term "locally" means that the "RTS", "CTS" states on the status lines RTS, CTS are not transmitted via the air interface LSS or the status lines RTS, CTS are not "looped through" via the air interface LSS.

In contrast to this, the information on the other lines or status lines of the V.24 cable $K_{V.24}$ is transmitted via the air interface LSS, or these lines are "looped through" via the air interface LSS.

If it detects or has received the first command data KD1, the first V.24 data transmission apparatus DÜG1 switches to a second special mode SM2 assigned to the "software handshake", in which the first V.24 data transmission apparatus DÜG1, in relation to the data stream transmitted between the data terminal DEE and the first V.24 data transmission apparatus DÜG1 on the data lines TxD, RxD, locally handles the "RTS", "CTS" states transmitted in this data stream. The term "locally" means that the "RTS", "CTS" states and software handshake characters are not transmitted via the air interface LSS.

If it detects or has received the second command data KD2, the second V.24 data transmission apparatus DÜG2 switches to a third special mode SM3 assigned to the "hardware handshake", in which the second V.24 data transmission apparatus DÜG2, in relation to the status lines RTS, CTS, locally handles the "RTS", "CTS" states transmitted on these lines between the data transmission device DÜE and the second V.24 data transmission apparatus DÜG2. The term "locally" means that the "RTS", "CTS" states on the status lines RTS, CTS are not transmitted via the air interface LSS. In contrast to this, the information is transmitted on the other lines or status lines of the V.24 cable $K_{V.24}$ via the air interface LSS.

If it detects or has received the first command data KD1, the second V.24 data transmission apparatus DÜG2 switches to a fourth special mode SM4 assigned to the "software handshake", in which the second V.24 data transmission apparatus DÜG2, in relation to the data stream transmitted between the data transmission device DÜE and the second V.24 data transmission apparatus DÜG2 on the data lines TxD, RxD, locally handles the "RTS", "CTS" states transmitted in this data stream. The term "locally" means that the

"RTS", "CTS" states and software handshake characters are not transmitted via the air interface LSS.